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TTI 1103 DIGITAL TRANSMISSION TEST SET

Interim Operating Instructions

Telecommunications Technology, Inc

PACIFIC TELEPHONE
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732-6240

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1.0 GENERAL

1.01 The TTI 1103 Digital Transmission Test Set provides a digital readout of transmission level and frequency, and it includes a tunable oscillator to furnish the necessary test signals. The instrument can be used for transmission level and frequency measurements on voice, program, or data channels. It can also be used in such applications as the lineup of Touchtone receivers and multi-frequency equipment.

1.02 Autoranging circuitry automatically selects the correct level range between -50 dBm and +10 dBm, the dynamic range of the instrument for both level and frequency measurements. Transmission level in this range is displayed to a resolution of 0.1 dB. The frequency of an external signal or the internal oscillator can be measured to a resolution of 10 Hz, 1 Hz, or 0.1 Hz.

1.03 The oscillator provides a test tone that is continuously variable in both level and frequency. The level range is -26 dBm to +10 dBm. The frequency range is 50 Hz to 60 kHz, in two bands. Switching between the bands is automatic, and only one control is used.

1.04 Push-button controls permit the operator to select either terminated or bridged measurements on 135-, 600-, or 900-ohm circuits. These same controls also select the output impedance of the oscillator. The output impedance is resistive.

1.05 With the instrument set for terminated measurement, no plug inserted in the OUTPUT jack, and the INPUT/OUTPUT switch set to OUTPUT, the

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instrument is automatically terminated internally to monitor the oscillator output. When a plug is inserted in the OUTPUT jack, the instrument monitors the output in a bridging mode. In this arrangement, level readings are in true dBm when the load impedance is matched to the oscillator output impedance (135, 600, or 900 ohms).

NOTE: Oscillator output level should not be adjusted with a plug in the output jack. See paragraph 4.01.

1.06 The TTI 1103 is equipped for operation from 115 or 230 volts AC.

The instrument weighs approximately 10-1/2 pounds. It is 5-1/4 inches high, 7-3/4 inches wide, and 11-1/4 inches deep. A carrying handle and power cord are standard equipment.

2.0 OPERATION

2.01 This section describes the method of connecting the TTI 1103 to the circuit to be tested, the operating controls of the instrument, and the measurement display.

Connecting the Instrument

2.02 Separate INPUT and OUTPUT connections are provided on the front panel. Front connection is by means of test cords provided with 310 plugs. A terminal strip on the rear of the instrument provides for semi-permanent or permanent input/output connections--for example, where the instrument is rack-mounted and the signal is fed to it through a jack panel. A third front-panel jack (DIAL) permits a dial set to be plugged in for dialing up a test circuit. The TTI 1103 operates from either 115 or 230 volts, single-phase AC.

CAUTION: MAKE SURE THE POWER SUPPLY SWITCH ON THE REAR OF THE INSTRUMENT IS SET TO THE APPROPRIATE VOLTAGE (115 or 230) BEFORE THE POWER CORD IS PLUGGED IN.

Operating Controls

2.03 The front-panel operating controls of the TTI 1103 are as follows:

a. POWER: A push-button power switch turns the instrument on and off.

b. TERMINATION: Five push-button switches select either bridging or terminated measurements, along with the appropriate impedance for the circuit under test--135, 600, or 900 ohms. The impedance switches also control the output impedance of the oscillator.

c. MODE: For level measurements, set the MODE switch to "dBm." For frequency measurements, use the MODE switch to select the desired resolution--10 Hz, 1 Hz, or 0.1 Hz. These settings are used whether measurements are being made on an external circuit or on the instrument's internal oscillator. The output of the oscillator is not controlled by the MODE switch.

NOTE: Regardless of the desired frequency resolution, always check the instrument set-up by switching first to 10-Hz resolution. This will ensure that a frequency of 41 kHz, for example, will not be interpreted as 1 kHz.

d. OSCILLATOR: The oscillator output is available at the OUTPUT jack, and is controlled by the LEVEL and FREQUENCY controls. With no plug inserted in the OUTPUT jack, the instrument will monitor the oscillator output ('INPUT/OUTPUT switch set to "OUTPUT")

in a bridged or terminated mode. (Set BRDG or TERM switch as required). When a plug is inserted in the OUTPUT jack, the oscillator is terminated by the external load; the level is monitored on a bridging basis automatically. In this bridged monitoring arrangement, the level readings are in true dBm only when the load impedance is matched to the oscillator output impedance (135, 600, 900 ohms).

NOTE: Oscillator output level should be adjusted with no plug inserted in the OUTPUT jack. DO NOT readjust the level with a circuit plugged in, as erroneous level readings may result. See paragraph 4.01.

The FREQUENCY control is a 10-turn potentiometer that controls both frequency bands. Switching between the bands is automatic. Switching from the low band to the high band occurs at slightly above 5 kHz, and switching from the high band to the low band occurs at slightly below 5 kHz. For example, suppose the oscillator is operating in the low band, and it is desired to adjust the frequency to 6 kHz. Simply turn the FREQUENCY control in the clockwise direction until the frequency display indicates that the oscillator has shifted to the high band. (The oscillator will then be operating near the top of the high band--at approximately 50 kHz.) Then turn the FREQUENCY control counter-clockwise until the display indicates 6 kHz. The reverse procedure is used to shift from the high band to the low band.

e. TEST/DIAL switch: The TEST/DIAL switch should be placed in the TEST position to make measurements on an external circuit or to monitor the oscillator output. The DIAL position permits a circuit to be dialed up for measurements. To do this, connect the line to the INPUT jack (or to the input terminals on the rear panel) and the dial set to the DIAL jack. Place the TEST/DIAL switch to the DIAL position to dial up the circuit (this effectively disconnects the Transmission Test Set from the test circuit), and depress the TERM switch. When the desired circuit has been dialed up, place the TEST/DIAL switch in the TEST position before going ON-HOOK or unplugging the dial set. The instrument will then hold the circuit while measurements are made with the dial set ON-HOOK or unplugged. For additional information, see Section 3.

f. OUTPUT/INPUT switch: When the OUTPUT/INPUT switch is placed in the INPUT position, the instrument measures a signal applied from an external source, such as a circuit under test. When the switch is placed in the OUTPUT position, the instrument measures the output of its own internal oscillator.

Oscillator Remote Control

2.04 The frequency of the 1103 oscillator can be controlled remotely by applying a dc voltage to the terminalstrip on the rear of the instrument. To do this, first set the rear-panel switch to EXTERNAL. Then connect the positive lead to V and the negative lead to GRD on the OSCILLATOR CONTROL terminals on the rear panel.

2.05 With this arrangement, the front panel frequency control acts as an offset adjustment. The front panel control should be adjusted so that 0 volt applied to the rear terminals produces the minimum desired frequency--typically 100 Hz to 500 Hz. Output frequency is linearly proportional to the control voltage. At about +8.5 volts (the precise voltage depends on the setting of front panel control), the oscillator reaches the upper end of its low band--slightly above 5 kHz. It then shifts automatically to the high end of the high band, just as it does in manual operation. Reducing the control voltage then produces a proportionate reduction in frequency until the oscillator shifts back to the low end of the low band. This shift takes place slightly below 5 kHz, at a control voltage of about 0.5 volt--the exact voltage again depends on the front panel control setting.

2.06 This remote control feature can be used for a variety of test functions. For example, the application of a simple ramp voltage will cause the oscillator frequency to sweep. Alternatively, any desired discrete frequencies can be produced simply by applying the appropriate precision voltages.

3.0 MAKING FULL USE OF THE TEST/DIAL CAPABILITY

3.01 The basic functions of the TEST/DIAL switch and the DIAL jack are described in Paragraph 2.03 (3). However, a fuller understanding of the test/dial operation can add considerable versatility to the instrument.

3.02 The DIAL jack is directly in parallel with either the INPUT or the OUTPUT jack, depending on the setting of the INPUT/OUTPUT switch.

The TEST/DIAL switch has no effect on this parallel relationship. The function of the switch is to disconnect the rest of the instrument from the jacks when the switch is in the DIAL position. With the switch set to DIAL, the internal impedance of the instrument is lifted, and dialing can be accomplished on a two-wire facility connected to either the INPUT or the OUTPUT jack (so long as the position of the INPUT/OUTPUT switch corresponds to the actual jack in use).

3.03 This arrangement makes it convenient to measure the level and frequency of an incoming signal, then to send a signal on the same circuit without dropping the circuit. To do this, it is important that the oscillator output be set, initially, to provide the appropriate level and frequency. The measurements of the incoming signal will normally then be made with the TEST/DIAL switch in the TEST position and the INPUT/OUTPUT switch in the INPUT position. When these measurements have been completed, patch a test cord from the OUTPUT jack to the DIAL jack. Arranged this way, the 1103 is delivering the appropriate signal to the two-wire circuit that is connected to the INPUT jack.

3.04 With the TEST/DIAL switch in the TEST position, and the INPUT/OUTPUT switch set to OUTPUT, the 1103 output signal is available at either the OUTPUT jack, the DIAL jack, or both.

NOTE: Normal precautions regarding termination must be observed. Plugging into the OUTPUT jack removes the internal terminating impedance to prevent double termination.

Plugging into the DIAL jack does not disconnect the internal terminating impedance.

3.05 The parallel arrangement of the 1103 jacks described above provides a convenient means of connecting other test equipment while the 1103 is used to hold the circuit. For example, suppose a circuit carrying an incoming test tone is connected to the INPUT jack, with the INPUT/OUTPUT switch in the INPUT position. After level and frequency measurements have been completed, a phase jitter test set can be connected to the DIAL jack to receive the same signal.

NOTE: While the phase jitter test set is connected, there will be a double termination unless the 1103 is switched to BRDG. Such a double termination will not affect the operation of an instrument such as the TTI 1200 Phase Jitter Test Set. However, a double termination may affect the operation of some instruments. This limitation may be overcome by connecting the other instrument to the PRE-DETECTED OUTPUT terminals available at the rear of the the 1103.

4.0 SETTING UP THE OSCILLATOR

4.01 For accurate power output, the 1103 oscillator level should always be adjusted with no plug inserted in the OUTPUT jack. This way, the oscillator is working into an internal precision resistive termination (135, 600, or 900 ohms, depending on impedance selection). When a circuit is plugged into the OUTPUT jack, the internal termination is disconnected and the external circuit provides the termination for the oscillator. If the circuit impedance is equal to the instrument's internal terminating resistance, the oscillator level will not change when the circuit is plugged in. However, if the circuit impedance is not equal to the terminating resistance in the instrument, the oscillator level will change. The OSCILLATOR LEVEL SHOULD NOT BE READJUSTED WITH THE CIRCUIT CONNECTED, even though the level has changed from the original set-up.

4.02 The behavior of the 1103 oscillator is exactly the same as that of an ordinary oscillator when a circuit with mismatched impedance is connected. The difference is that there is no convenient way to monitor the level change with an ordinary oscillator; whereas the level change is immediately apparent on the 1103 display. An ordinary oscillator would not be readjusted with the circuit connected. To do so with the 1103 would not permit correlation with standardized test procedures.

NOTE: When the 1103 is connected via the input/output terminals on the rear panel, a dummy plug should be inserted in the OUTPUT jack to lift the internal termination when the instrument is sending a signal into a circuit. Failure to use the dummy plug under these conditions will result in double terminating the oscillator.

5.0 SPECIFICATIONS

Measurement Frequency Range:	50 Hz to 60 kHz
Measurement Level Range:	-50 to +10 dBm
Input/Output Impedances:	135, 600, and 900 ohms ±0.2% balanced or unbalanced; bridging is 200 k ohms minimum
Input Protection:	DC input: Blocks 50 volts, either terminal to ground Spikes: Withstands 600-volt, 10 μsec spikes across input terminals Longitudinal voltage (operating limit): 30 volts rms Metallic voltage: 50 volts rms
Readout:	Nixie display, 4 digits, "+" or "-" sign, and "dBm" or "kHz"
Blanking:	Automatic blanking above (+ sign remains on) and below (- sign remains on) the measurement range

Level Measurement:

Resolution:	0.1 dB
Variation vs. frequency:	100 Hz to 5 kHz: ±0.02 dB 100 Hz to 20 kHz: ±0.04 dB 100 Hz to 50 kHz: ±0.07 dB
Level variation vs. temperature:	0° to 50°C: ±0.002 dB/°C
Level variation vs. AC power:	±10%: less than 0.01 dB

Frequency Measurement:

Resolution:	0.1, 1.0, and 10 Hz (switch selectable)
Accuracy:	1 part 10^5

Signal Source:

Frequency bands:	50 Hz to 5 kHz; 5 kHz to 60 kHz
Frequency adjustment:	Single control (automatic band switching)

Frequency stability:. Short term (10 min.):

100 to 9999 Hz	1 Hz
10 to 50 kHz	5 Hz

Long term (2 hours):

100 to 9999 Hz	5 Hz
10 to 50 kHz	10 Hz

Frequency accuracy:. 1 part 10^5

Power output flatness vs. frequency, 100 Hz to 50 kHz: . . . . . 0.1 dB

Total harmonic distortion:. . . . . Less than 1.5% (-36.5 dB) up to +7 dBm, 50 Hz to 60 kHz. Typically less than 0.5% (-46 dB).

Output Power:

Control: . . . . . Continuously adjustable

Settability: . . . . 0.1 dB

Accuracy:. . . . . 0.1 dB

Range: . . . . . -26 to +10 dBm (-26 to +5 dBm at 135-ohm impedance)

Power Supply . . . . . AC only: 115/230 volts ±10%, 45 to 400 Hz

Weight . . . . . 10.5 pounds

Size:. . . . . Height: 5-1/4 inches
Width: 7-3/4 inches
Depth: 11-1/4 inches

Input/Output/Signal Terminals: . . . . . Front: 310 jacks
Rear: Terminal Strip

Operating Temperature Range: . . . . . 0° to 50°C

WARRANTY

TTI warrants instruments manufactured by it to be free from defects in material and workmanship under normal use and service within specified ratings and operating conditions. Our obligation under this Warranty is limited to the repair or replacement, at TTI's sole discretion, of any instrument or part thereof which, when returned pre-paid to TTI within one year of original shipment and upon our examination proves to be thus defective. This warranty includes the cost of return surface transportation from the factory. It does not include the cost of transportation to the factory and/or the cost of packaging the instrument for return to the factory, unless such instrument is returned within 30 days from the date of original shipment and prior written authorization for the reimbursement of such cost is obtained from the factory.

This Warranty shall not apply to any instrument which has been (1) repaired, worked on, or altered by persons not authorized by TTI so as, in TTI's sole judgement, to injure the stability, reliability, or proper operation of such instrument; (2) subjected to misuse, negligence, or accident; and (3) connected, installed, used or adjusted otherwise than in accordance with the instructions furnished by TTI. Accessories, including, but not limited to, fuses and batteries, not of TTI's manufacture, used or installed with this instrument are not covered by this Warranty.

TTI reserves the right to make changes in the design or construction of its instruments at any time without incurring any obligation to make these changes in instruments previously sold and delivered.

The repair or replacement of any part or parts of an instrument under this agreement does not void or extend the original Warranty period for the whole instrument. Repaired or replaced parts are warranted for the remainder of the instrument warranty period or for 90 days from the date of repair, whichever shall be longer.

We are not liable for consequential or incidental damages. This Warranty is in lieu of all others expressed or implied and no representative or person is authorized to assume for us any other obligations or liabilities in connection with the sale of TTI instruments and products.

From_____

To: Telecommunications Technology, Inc.
555 Del Rey
Sunnyvale, California 94086

In the event of malfunction, please complete this report and return it in the shipping container with the instrument. A shipping label is attached for your convenience.

Company_____
Dept_____
Address_____

Instrument Model # _____
Serial # _____
TTI Shipping Date_____

(Shipping date appears on last page of instruction manual. Warranty expires one year from this date.)

☐ Please furnish estimate before proceeding with repair.

DETAILED DESCRIPTION OF MALFUNCTION

Signature_____
Title_____

FACTORY REPAIR SERVICE

TTI maintains a complete facility to repair any TTI instrument, whether or not the necessary repair is covered by the warranty.

Malfunction Report

Any instrument returned to the factory for repair, whether covered by warranty or not, should be accompanied by the malfunction report (the following page of this manual). This report should be completed in as much detail as possible to assure quick and complete correction at the factory.

Shipping Instructions

Make sure the instrument is adequately packed to prevent damage in transit. TTI will not be responsible for such damage. If possible, the instrument should be returned in its original shipping container. If this is not possible, use a shipping container that allows for at least four inches of high-quality packing material on every side of the instrument.

Ship the instrument prepaid to

Telecommunications Technology, Inc.
555 Del Rey
Sunnyvale, California 94086

The tear-out shipping label on the malfunction report may be used.

Charges

The warranty does not cover shipping charges to the TTI factory. However, if the instrument is in warranty, TTI will pay the cost of surface shipment from the factory.

If the instrument is not in warranty, TTI will bill for the repair at normal rates. Shipping costs will be billed at TTI's cost.

Instrument serial number_____

TTI Shipping date_____

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